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SUBJECT: ESTIMATION OF POWER PRODUCTION FROM RB5 DAIRIES

The attached chart provides an estimate of the potential electrical generation that could be realized from anaerobic digestion of manure at dairies within the geographic area of the Central Valley Regional Water Quality Control Board (CVRWQCB). As shown, if all dairies utilized anaerobic digesters, the potential energy generation could achieve 1,530 GigaWatt hours per year (GWh/year). California consumes approximately 265,000 GWh/year (CPUC website).

For graphing purposes, the number of dairies and number of mature cows was obtained from the CVRWQCB Master Dairy List. Dairies with fewer than 2,000 cows were divided into increments of 100 cows in size. Dairies with 2,000 to 6,000 cows were divided into increments of 1,000 cows. Those dairies with more than 6,000 cows were combined into a single increment. The number of dairies and number of cows in each increment were totaled. The number of dairies in each increment is shown as the vertical bars on the accompanying chart.

The potential electrical power generation was estimated for each increment. The formula to estimate potential power generation obtained from the California Energy Commission is (mature dairy cows) * (10lbs volatile solids/cow/day) * (60% volatile solids digestible) * (12 ft^3 biogas/lb volatile solid) * (50% methane content) * (1000BTU/ft^3 methane) * (1kWh/14,000BTU) * (GWh/1,000,000 kWh) * (365 days) and calculated as:

1,630,460 Mature Cows	
x 10lbs volatile solids / cow / day	16,304,600 lbs. Volatile solids per day
x 60% of volatile solids are digestible.....	9,782,760 lbs of volatile solids digested
x 12 ft^3 biogas / lb. of volatile solids digested	117,393,120 ft^3 biogas produced per day
x 50% methane content of biogas.....	58,696,560 ft^3 methane produced per day
x 1,000BTU / ft^3 methane	5.8697 x 10^{10} BTUs per day
÷ 14,000BTU / kWh	4,192,611 kiloWatt hours (kWh) per day
÷ 1,000,000 kWh / GWh	4.19 GWh per day
x 365 days / year.....	1,530 GWh per year

Cumulative potential power generation (GWh/yr) is plotted as diamond markers on the chart and read from the left, increasing as increments are added to the total. The calculation presumes that all dairies would have digesters and capture all of the methane from all mature dairy cows. As such, it is improbable that this potential could be fully realized. Nonetheless, the information provides a reasonable theoretical estimate of potential methane production, greenhouse gas reduction, and power generation that could be realized by anaerobic digestion of dairy waste within the CVRWQCB.

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POTENTIAL POWER GENERATION BY RB5 DAIRIES

Data source is RB5 Master Dairy List. Data set is 1,522 dairies with 1,630,460 mature cows. Electricity calculated as (1,630,460 mature cows)*(10lbs volatile solids/cow/day)*(60% volatile solids digestible)*(12 ft3 biogas/lb volatile solids digested)*(50% methane content)*(1000BTU/ft3 methane)*(1kWh/14,000BTU)*(GWh/1,000,000 kWh)*(365 days)